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Bibler

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[54] **LOG SORTING CONVEYOR**

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[73] Assignee: **Bibler Brother, Inc.,** Russellville, Ark.

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[21] Appl. No.: **614,657**

[52] **U.S. Cl.** ..... **209/74 R;** 209/125; 198/370

[51] **Int. Cl.²** **B65G 21/00**

[58] **Field of Search** ..... 209/74 R, 125; 214/768, 214/62 A; 298/18, 22 P; 105/270, 261 R; 198/27, 38, 155, 185, 370

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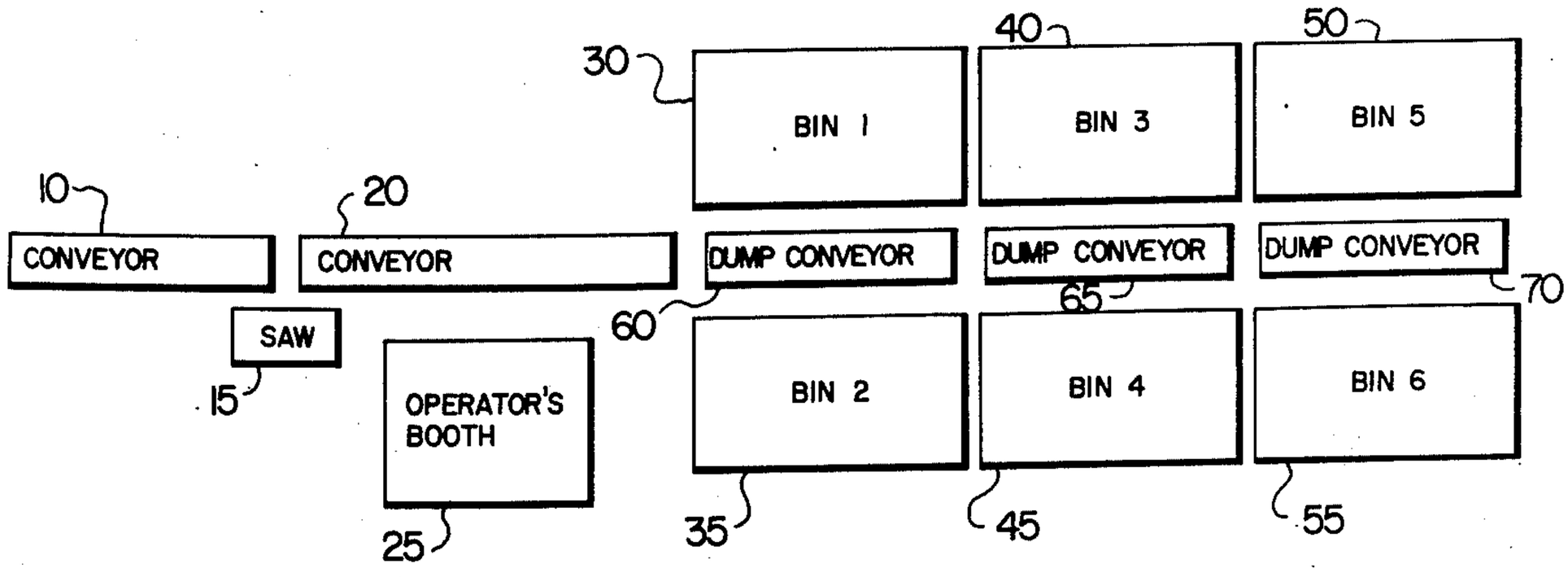
Primary Examiner—Drayton E. Hoffman
Assistant Examiner—Joseph J. Rolla
Attorney, Agent, or Firm—Giles C. Clegg, Jr.

[57] **ABSTRACT**

A conveyor for sorting logs is pivotably mounted on a support structure and is rotatable about an axis parallel to the direction of log transport. The apparatus includes double chamber pneumatic cylinders which may be selectively actuated to pivot the conveyor to dump logs therefrom to either side of the support structure. Limit switches on the conveyor are operatively connected in a control circuit arrangement to prevent the piston within the cylinders from reaching its limit of travel, thereby providing an air cushioned, shock absorber effect. The conveyor drive mechanism acts as a counterweight to return the conveyor to a level orientation.

10 Claims, 6 Drawing Figures



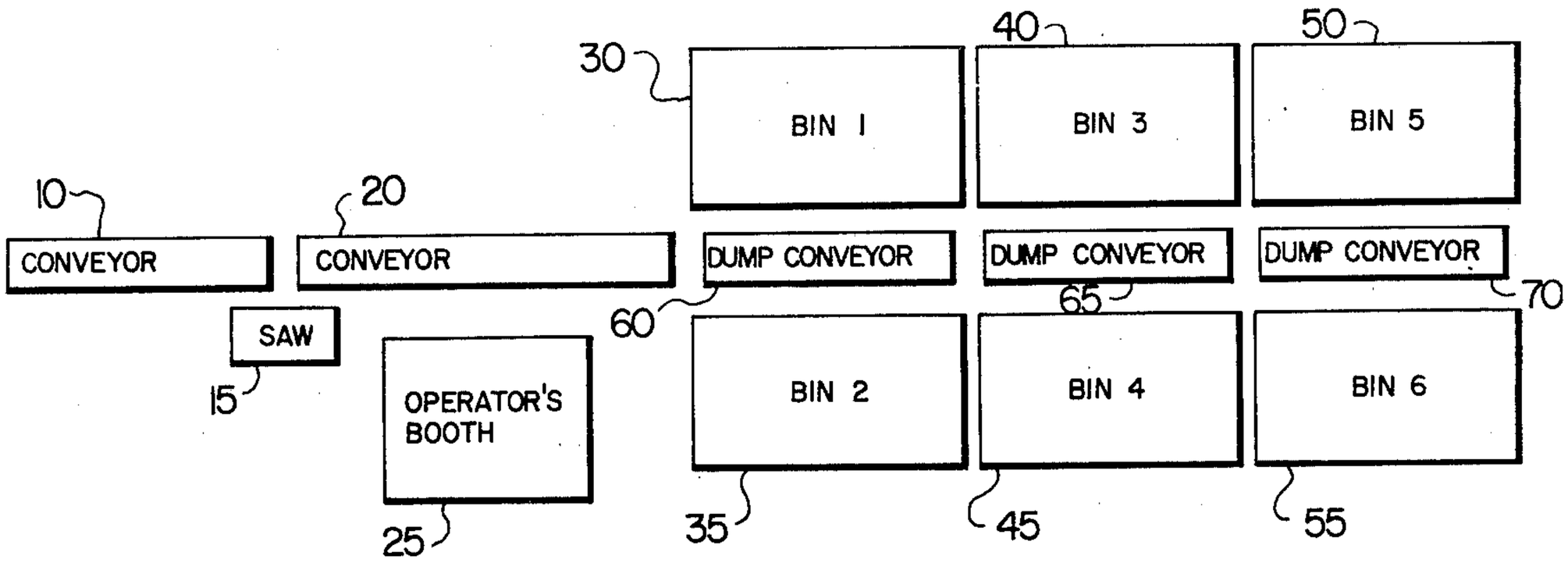


FIG. 1

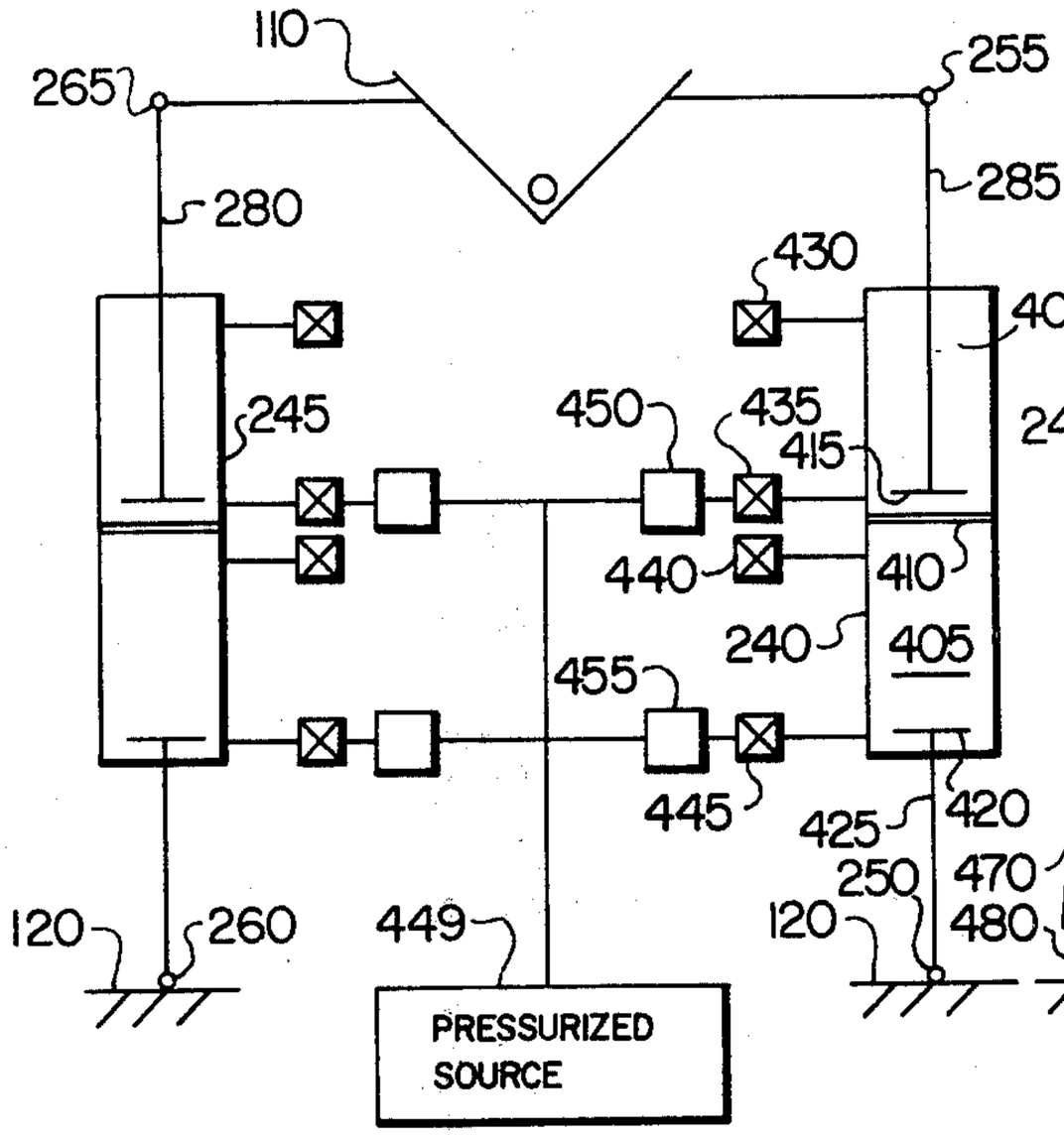


FIG. 4A

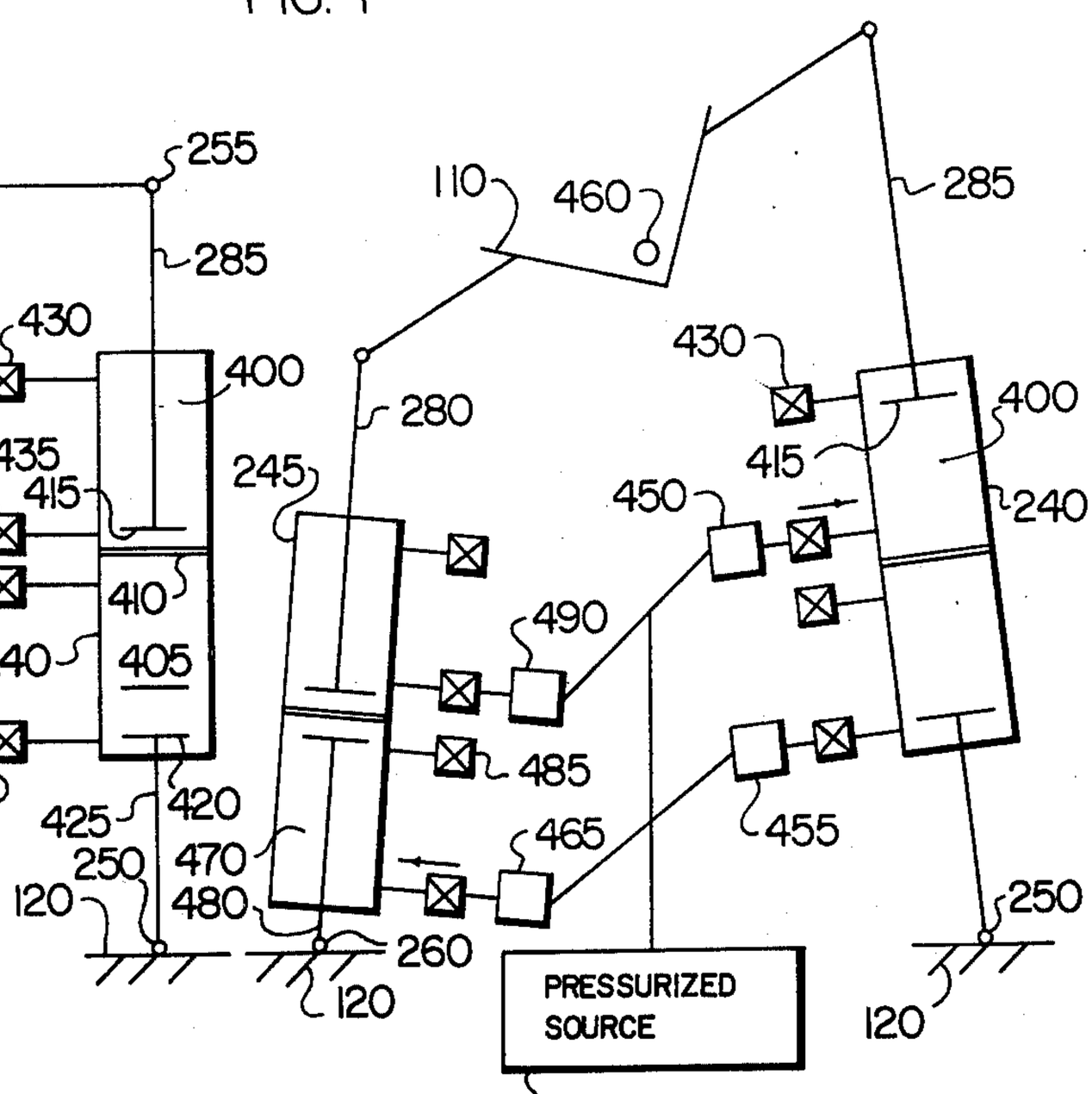


FIG. 4B

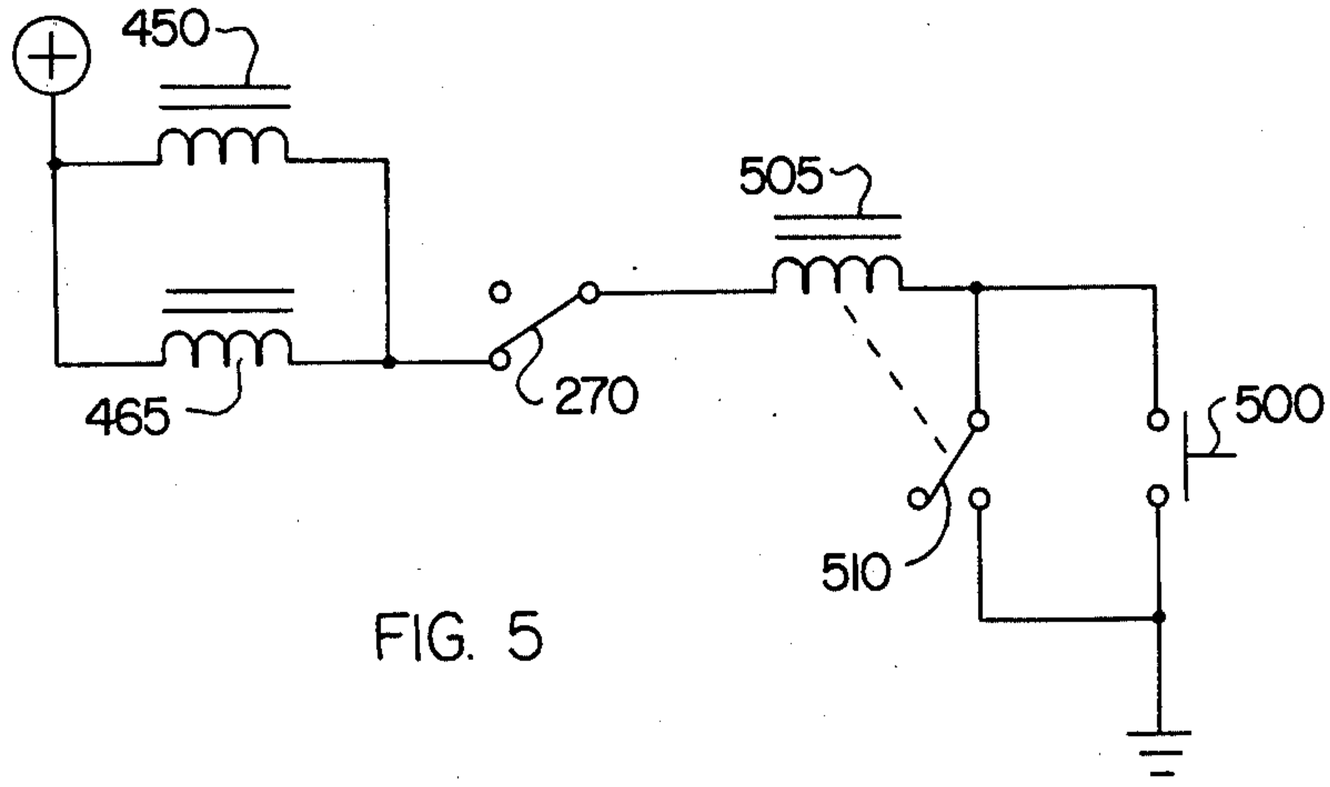


FIG. 5

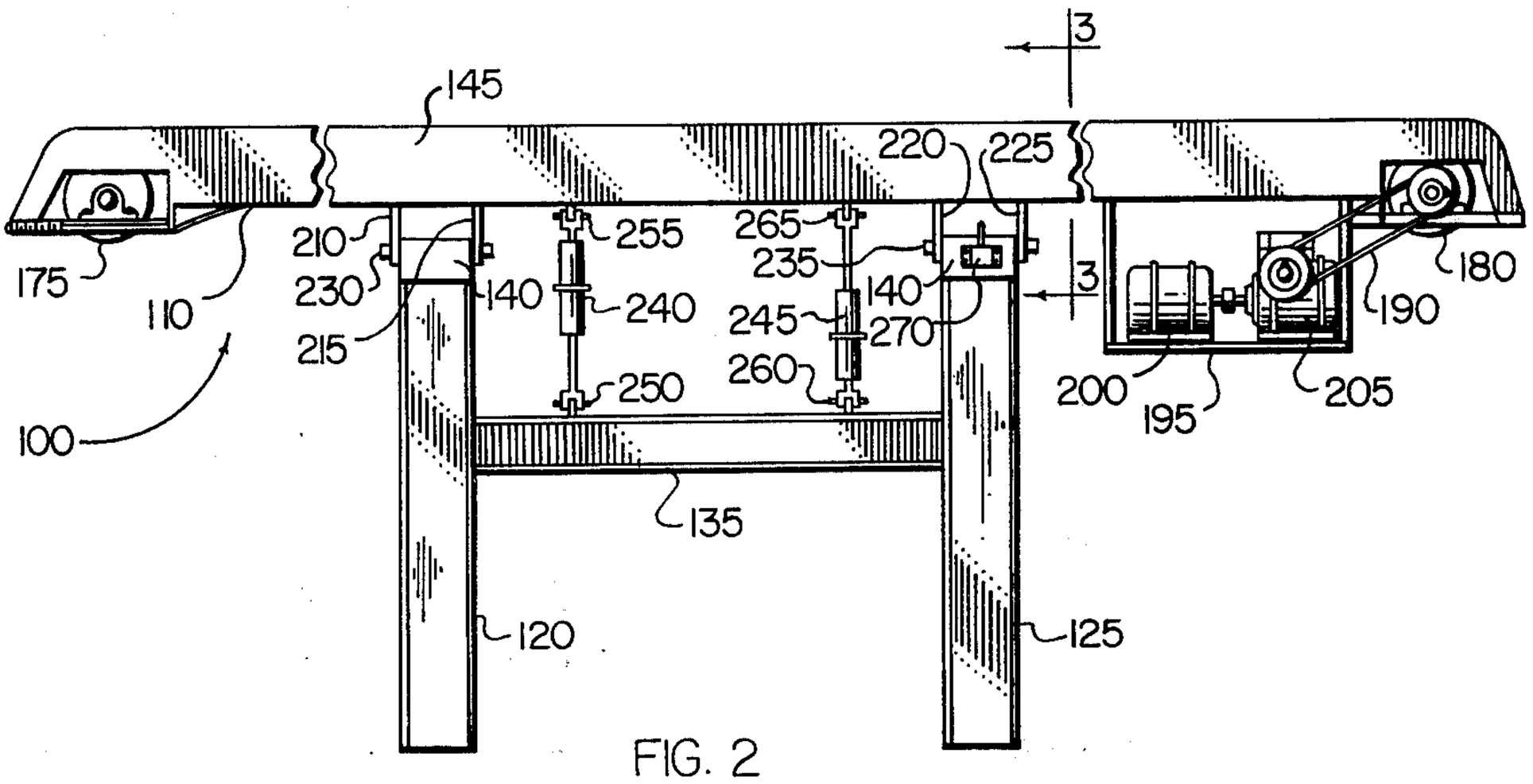
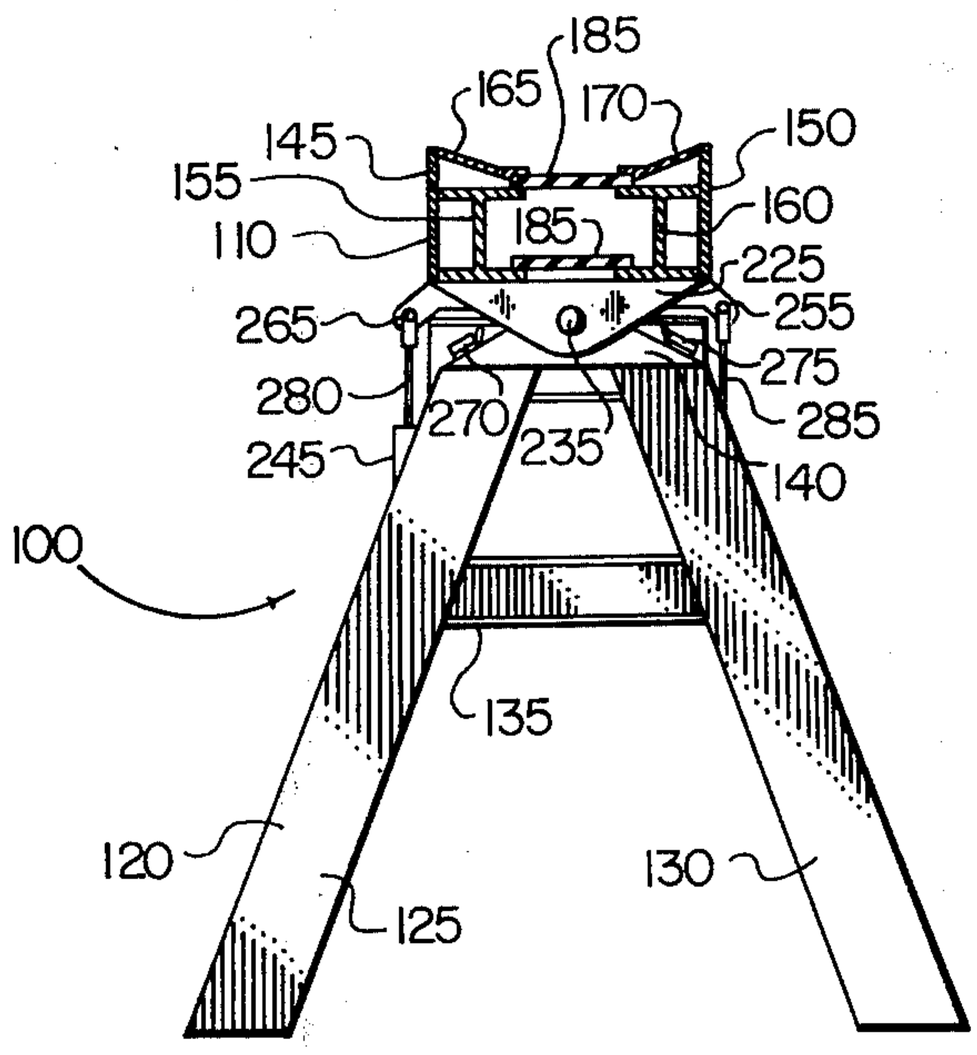

3
145
220
225
210
255
265
235
230
140
140
180
175
110
240
245
270
190
215
260
250
200
195
205
100
135
120
125

FIG. 2


185
165
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145
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155
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185
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225
265
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280
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245
140
100
135
120
130
125

FIG. 3

LOG SORTING CONVEYOR

BACKGROUND OF THE INVENTION

This invention relates to log conveying mechanisms and, more particularly, to apparatus for conveying and sorting logs.

In log processing centers, it is desired to sort logs according to different characteristics such as, for example, diameter, length, type of wood, suitability for lumber or paper pulp material, etc. In such a system, logs are placed end to end on a conveyor and are transported past a plurality of sorting stations. Such a system is disclosed, for example, in co-pending application Ser. No. 614,656, entitled "Method And Apparatus For Processing Logs", assigned to the assignee of this invention, filed on even date herewith. Heretofore, as a log passed a sorting station where it was desired to transfer the log from the conveyor belt to a stack, typical apparatus for performing such a function included a "log kicker" which pushed the log laterally off one side of the conveyor. In order to conserve space and reduce the cost associated with long conveyor lines, it would be desirable to have apparatus capable of displacing logs to either side of the conveyor.

SUMMARY OF THE INVENTION

In accordance with the principles of this invention, apparatus is provided for conveying and sorting logs. A conveyor frame is pivotably mounted on a support structure, the pivot axis being parallel to the direction of movement of the conveyor belt. Double chamber pneumatic cylinders are actuated selectively to pivot the conveyor to one side or the other a sufficient angular amount to cause a log on the conveyor to roll laterally thereoff. Limit switches mounted on the apparatus are actuated when the conveyor has rotated to a particular point, terminating the actuation of the cylinders. The conveyor drive mechanism is mounted below the conveyor pivot point to act as a counterweight to return the conveyor to its level position after the log is displaced. The limit switches are positioned to be actuated before the limit of travel of the piston within the pneumatic cylinder is reached, the cylinders thereby acting as shock absorbers.

DESCRIPTION OF THE DRAWING

The foregoing will be more readily apparent upon reading the following description in conjunction with the drawing in which:

FIG. **1** depicts a schematic plan view of a log conveying and sorting system in which the apparatus of the present invention finds particular utility;

FIG. **2** depicts a side view of an illustrative conveyor constructed in accordance with the principles of this invention;

FIG. **3** depicts a cross-sectional view of the conveyor structure taken along the line **3—3** of FIG. **2;**

FIG. **4A** and **4B** depict schematic diagrams illustrating the operation of the pneumatic cylinders of the apparatus of FIG. **2;** and

FIG. **5** depicts a schematic diagram of an illustrative control circuit for operating the apparatus according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1,** shown therein is a schematic plan view of a log conveying and sorting system of the type described in the aforementioned co-pending application. In the illustrative system, logs travel from left to right, entering on conveyor **10.** The logs are cut to length by saw **15** and the cut lengths of log then travel along conveyor **20.** An operator in booth **25** examines the logs on conveyor **20** and determines into which of bins **30, 35, 40, 45, 50,** and **55** the logs are to be sorted. This determination may be based upon any of several factors, such as log diameter, log length, or type of wood, depending upon the particular application. The logs from conveyor **20** are transported to conveyor **60,** a conveyor of the type according to this invention which will be described in greater detail hereinafter. If the operator in booth **25** has determined that the particular log is to be sorted into bin **30** or bin **35,** the operator closes the respective switch and conveyor **60** pivots in the proper direction to roll the log thereoff into the selected bin. If the particular log is not to go into bin **30** or **35,** it is transported to conveyor **65,** another conveyor constructed in accordance with the principles of this invention. If the operator determines that the log on conveyor **65** is to go into bin **40** or **45,** the proper switch is activated to cause conveyor **65** to pivot and roll the log thereoff into the proper bin. If the log is not to go into bin **40** or **45,** the log is transported to conveyor **70.** The operator in booth **25** then activates the proper switch to cause conveyor **70** to pivot and roll the log thereoff into either bin **50** or **55.** In the illustrative system of FIG. **1** six bins are shown. It is contemplated that the system may be reduced or expanded to any number of bins, each pair of bins having therebetween a conveyor of the type constructed in accordance with the principles of this invention.

Referring now to FIGS. **2** and **3,** shown therein are views of an illustrative conveyor **100** constructed in accordance with the principles of this invention which may be utilized as any of the conveyors **60, 65** or **70** of FIG. **1.** Conveyor **100** includes a conveyor frame **110** mounted on a support structure **120.** Support structure **120** includes a pair of spaced apart support frames, each of the frames including a pair of oppositely inclined beams **125** and **130.** Support structure **120** also includes a platform **135** mounted between the support frames. The inclined beams **125** and **130** are joined at their upper ends by a member **140** which serves to provide a pivot point, as will be described more fully hereinafter. The inclined beams **125** and **130** provide the dual function of supporting the conveyor apparatus and guiding logs which are dumped into the appropriate bin.

Conveyor frame **110** includes side members **145** and **150,** beams **155** and **160,** and through forming members **165** and **170,** arranged as shown in FIG. **3.** Conveyor frame **110** also includes drive rollers **175** and **180,** around which is looped endless conveyor belt **185.** A belt of PVC or similar abrasion resistant belting has been found satisfactory for use in a conveyor handling relatively small logs up to 7 – 10 inches in diameter. It has been discovered that box chain of the type frequently used for conveying sawdust and similar fungible materials is best suited for use when large logs are to be handled. The drive rollers may be smooth when belting is used, but include projections to engage the

box chain when it is utilized. When the box chain is utilized, it is preferred that I beams **155** and **160** be disposed as shown in FIG. **3** with the ends of the beams acting as rails. Loose material such as bark can fall through. On the other hand, if belting is used it is desirable that the upper run of the conveyor be over a substantially solid floor. Mounted below conveyor frame **110** and coupled to roller **180** through drive belt **190** is conveyor drive mechanism **195** which includes a conventional motor **200** and transmission **205.** To pivotably connect conveyor frame **110** to support structure **120,** triangular shaped members **210, 215, 220** and **225** are mounted on the bottom of beams **155** and **160.** Openings are provided through triangular plate members **210, 215, 220** and **225** near the apex opposite the side mounted to conveyor frame **110.** These openings correspond to openings through members **140** on support structure **120.** Through these openings are passed pins **230** and **235.** These pins **230** and **235** serve a dual function; they connect conveyor frame **110** to support structure **120** and provide a pivot axis for conveyor frame **110.**

Conveyor frame **110** is also connected to support structure **120** through double chamber pneumatic cylinders **240** and **245.** Cylinders **240** and **245** are pivotably connected to conveyor frame **110** and support structure **120** by means of pins **250, 255, 260** and **265.** It is thus seen that if it is ever necessary to make repairs to conveyor frame **110,** it is a simple matter to remove conveyor frame **110** from support structure **120.** All that need be done is remove four pins; pins **230, 235, 255** and **265.**

Mounted on support structure **120** are limit switches **270** and **275.** These limit switches are connected in a control circuit arrangement, in a manner to be described hereinafter, so that the pistons within cylinders **240** and **245** do not reach their limit of travel when pivoting conveyor frame **110.** This provides a cushion of air within the cylinders to act as a shock absorber when conveyor frame **110** is pivoted.

Referring to FIGS. **4A** and **4B,** the dumping action of the conveyor apparatus according to this invention will be described. FIG. **4A** schematically depicts conveyor frame **110** connected to support structure **120** through double acting pneumatic cylinders **240** and **245** in its initial level position. It will be noted that one such cylinder will be sufficient for conveyors handling only small logs of up to 7 – 10 inches in diameter. FIG. **4B** schematically depicts the apparatus of FIG. **4A** where conveyor frame **110** has been counterclockwise pivoted. Pneumatic cylinder **240** comprises a pair of chambers **400** and **405** separated by a wall **410,** a piston head **415** in chamber **400** connected to rod **285** and a piston head **420** in chamber **405** connected to rod **425.** Cylinder **240** has four air lines connected thereto, one at each end of the chambers **400** and **405.** These air lines are connected to flow control valves **430, 435, 440** and **445.** The air lines provide for the control of the movement of the piston heads within the respective chambers. The flow control valves allow air to freely enter the respective chamber but restrict the flow of air leaving the chamber. It has been found particularly desirable to utilize adjustable flow control valves wherein the amount of air pressure in the chambers which is necessary before air may leave the chamber may be set into the valve. Flow control valves **430** and **440** are connected to the atmosphere while control valves **435** and **445** are connected to source **449** of pressurized air through solenoid valves **450** and **455,** respectively. When conveyor frame **110** is in its level position as shown in FIG. **4A,** piston heads **415** and **420** are near the lower ends of their respective chambers, and there is no flow of air into or out of the chambers. The arrangement for cylinder **245** is identical to that described for cylinder **240.**

FIG. **4B** schematically depicts conveyor frame **110** being pivoted about point **460** in a counterclockwise direction. When it is desired to pivot conveyor frame **110** in a counterclockwise direction, the operator in booth **25** (FIG. **1**) depresses the appropriate switch which energizes solenoid valve **450** to allow pressurized air to enter the lower end of chamber **400** of cylinder **240.** At the same time, solenoid valve **465** is energized to allow pressurized air to enter the lower end of chamber **470** of cylinder **245.** The air entering chamber **400** causes piston head **415** to push rod **285** up and the air entering chamber **470** causes cylinder **245** to be pulled down, since piston head **475** is firmly attached to support structure **120** through rod **480** and cannot move. As no air is entering the remaining two chambers, the piston heads therein do not change their relative positions. As air enters the lower portions of chambers **400** and **470,** air leaves the upper portions of these chambers in a restricted manner through flow control valve **430** and **485,** thereby cushioning the motion of conveyor frame **110.** After conveyor frame **110** has pivoted a predetermined amount, limit switch **270** (FIG. **3**) is activated. This causes the de-energization of solenoid valves **450** and **465.** However, the inertia generated by the log being dumped from conveyor **110** causes the conveyor to continue pivoting until the log has left the frame. At this point, the conveyor drive mechanism **195** which is below the pivot point **460** of conveyor frame **110** acts as a counterweight and causes conveyor frame **110** to return to its initial level position by pivoting clockwise from the position depicted in FIG. **4B.** Since flow control valves **445** and **485** restrict the flow of air out of the cylinder chambers **400** and **470,** respectively, a damping, or shock absorber, effect is achieved when conveyor frame **110** returns to its initial level position.

When it is desired to pivot conveyor frame **110** from the level position depicted in FIG. **4A** in a clockwise manner, the operator in booth **25** pushes a different button which causes air to enter to other chambers of cylinders **240** and **245** through solenoid valves **455** and **490,** the operation in this mode being analogous to that described above.

FIG. **5** depicts a schematic diagram of an illustrative control circuit for the counterclockwise pivoting of the apparatus according to this invention. An identical circuit may be similarly provided for clockwise pivoting. When it is desired to counterclockwise pivot conveyor frame **110,** push button **500** in operator's booth **25** is depressed. This energizes solenoids **450** and **465,** allowing pressurized air to enter chambers **400** and **470,** respectively, as described above. Relay **505** is also energized, closing it normally open contact **510.** Push button **500** may then be released. when conveyor frame **110** pivots the desired amount, the normally closed contact of limit switch **270** opens terminating the energization of solenoids **450** and **465** and allowing the counterweight effect of the conveyor drive mechanism to return conveyor frame **110** to its level position.

It will be noted that the logs being sorted typically weigh in excess of **1000** pounds, and once dumping is

initiated the weight of the log will cause the dumping operation to proceed until the log falls from the conveyor. The holding relay **505** is therefore not essential. It is considered desirable to provide the limit switches even if the relay **505** is not utilized to prevent damage to the apparatus if the operator should inadvertently cause air pressure to be supplied for an excessive period of time.

Whereas this invention has been described with respect to a single embodiment thereof, it is understood that a person of skill in the art may make modifications thereto without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for sorting logs to either side of a central transport path comprising:

conveyor means for transporting logs along said path, said conveyor means including a conveyor frame, an endless conveyor supported by said conveyor frame, drive means for driving said endless conveyor mounted on and below said conveyor frame and side members extending upward and outward from said endless conveyor to define a through preventing lateral displacement of logs being transported;

a support structure including means defining at least one central pivot point for connection to said conveyor frame, said pivot point being above the level of said drive means;

connecting means for connecting said conveyor means to said support structure at said pivot point, said connecting means including first pin means providing a pivot axis for said conveyor means;

pneumatic cylinder means connected between said conveyor means and said support structure effective when actuated for selectively causing said conveyor means to pivot about said axis; and

control means operable to cause the elective actuation of said pneumatic cylinder means to cause said conveyor means to be pivoted sufficiently to cause a log carried by said conveyor means to roll out of said trough to a selected side, said drive means acting as a counterweight to then cause said conveyor means to be returned to an initial level orientation.

2. The apparatus of claim **1** wherein said control means includes limit switch means associated with said conveyor means and responsive to a predetermined amount of pivoting of said conveyor means for providing a signal to terminate the actuation of said cylinder means.

3. The apparatus of claim **1** wherein said first pin means is removable and said apparatus further includes removable second pin means connecting said pneumatic cylinder means to said conveyor means, whereby said conveyor means including said drive means is removably connected to said support structure by only said first and second pin means.

4. The apparatus of claim **1** wherein said pneumatic cylinder means includes:

a pneumatic cylinder having a first chamber and a second chamber;

a first piston inside said first chamber;

a second piston inside said second chamber;

a first rod extending out from said first chamber and connected to said first piston and said conveyor means;

a second rod extending out from said second chamber and connected to said second piston and said support structure;

four air lines entering the end regions of said chambers, two of said air lines entering each of said chambers and separated by the piston in that chamber;

four flow control valves, each of said valves connected to a respective one of said air lines and adapted to allow air to freely enter the respective chamber and to restrict the flow of air from the respective chamber;

first valve means actuatable by said control means and connected to the air line entering the first chamber opposite the end of the first chamber through which extends the first rod;

second valve means actuatable by said control means and connected to the air line entering the second chamber at the end of the second chamber through which extends the second rod; and

a pressurized pneumatic source connected to said first and second valve means.

5. The apparatus of claim **4** wherein said flow control valves each are adjustable to retain a predetermined amount of pressure within their respective chamber before allowing the restricted flow of air from the respective chamber.

6. Log sorting apparatus comprising:

a conveyor having a length related to the length of logs to be sorted, said conveyor including a conveyor frame, an endless conveyor supported by said conveyor frame, drive means for driving said endless conveyor mounted on and beneath said conveyor frame and side members extending upward and outward from said endless conveyor to define a trough along which logs being sorted move with said side members preventing lateral displacement of logs being moved;

bin means positioned on each side of said conveyor for receiving logs which have been sorted;

at least two spaced apart support frames, each including a pair of oppositely inclined beams connected at their upper ends to form a pivot point above the level of said drive means;

first pin means pivotably connecting said conveyor to each of said support frames at said pivot points with said support frames supporting said conveyor above said bin means and said inclined beams guiding sorted logs into said bin means;

pneumatic cylinder means connected to said conveyor effective when actuated to selectively cause said conveyor to pivot toward one of said bin means sufficiently to cause a log carried by the conveyor to roll out of the conveyor and be directed by said inclined beams to said bin means;

control means operable to cause said selected actuation of said pneumatic cylinder means; and

limit switch means associated with said conveyor and responsive to a predetermined amount of pivotal movement of the conveyor for causing said control means to terminate the actuation of said pneumatic cylinder means, said drive means acting as a counterweight to return the conveyor to a normal level position.

7. The log sorting apparatus of claim **6** wherein said first pin means is removable and said log sorting apparatus further includes removable second pin means connecting said pneumatic cylinder means to said con-

veyor, whereby said conveyor including said drive means is removably connected to said support frames by only said first and second pin means.

8. The log sorting apparatus of claim **6** wherein said endles conveyor comprises a box chain.

9. The apparatus of claim **6** wherein said pneumatic cylinder means includes:

a pneumatic cylinder having a first chamber and a second chamber;

a first piston inside aid first chamber;

a second piston inside said second chamber;

a first rod extending out from said first chamber and connected to said first piston and said conveyor means;

a second rod extending out from said second chamber and connected to said second piston and said support structure;

four air lines entering the end regions of said chambers, two of said air lines entering each of said chambers and separated by the piston in that chamber;

four flow control valves, each of said valves connected to a respective one of said air lines and adapted to allow air to freely enter the respective chamber and to restrict the flow of air from the respective chamber;

first valve means actuatable by said control means and connected to the air line entering the first chamber opposite the end of the first chamber through which extends the first rod;

second valve means actuatable by said control means and connected to the air line entering the second chamber at the end of the second chamber through which extends the second rod; and

a pressurized pneumatic source connected to said first and second valve means.

10. The apparatus of claim **9** wherein said flow control valves each are adjustable to retain a predetermined amount of pressure within their respective chamber before allowing the restricted flow of air from the respective chamber.

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